

of a month, I ascertained that these usually sluggish mollusks occasionally swam, at an early hour of the day, resupinate at the surface. I am not aware that this habit has been remarked in the genus in question by any other observer.

I find the following description of the animal of an unpublished *Physa*, which I took, in 1846, at Michelvillè, between Cape Town and Hottentot Holland:—

Foot narrow, hinder extremity pointed, not extending beyond the summit of the spire. Head with veliform lobes or expansions in front. Tentacula subulate, lengthened, and somewhat spread all round at the base; the eyes being situated on these prominences, between the tentacula. Mantle reflected so as to cover merely the edge of the aperture all round, exposing the whole of the breathing cavity, at the hinder part of which, near the junction of the outer lip of the shell with the body-whorl, appears a tongue-like process.

8th December 1854.

III.—*Characters of the Genus Opisthoporus, an Eastern form of the Cyclostomacea, with Remarks on its Affinities and Notes on several Opercula.* By W. H. BENSON, Esq.

ON my passage through Zürich, last summer, Professor Mousson kindly afforded me an opportunity of comparing a shell transmitted to me by Dr. Traill from Borneo\* (identical with *Cyclostoma (Pterocyclos) Charbonnieri*, Recl., and *Cyclotus Taylorianus*, Pfr.), with the imperfect specimen of *Pterocyclos biciliatus*, Mouss., figured in the 'Mollusken von Java.' We found that they were in nowise to be distinguished from each other. I have long dissented from the received location of this, and allied species, in *Cyclotus* and *Pterocyclos*, with reference not only, in the case of the former, to the springing of a retroverted tube from the suture, but also to the formation of the operculum, which, externally, has some resemblance to the vertebra of a fish; or, as remarked by Recluz, is formed like a pulley, the broad edge of the disk being grooved or excavated in the direction of its circumference.

On a closer examination it will be found that this apparently solid operculum is formed by two layers, an inner and an outer one, the former having a horny coating: these two layers are united by an erect, internal, spiral lamina, the spaces between which are hollow and hermetically closed; and the concavity of

\* Vide 'Annals' for 1853, vol. xi. N.S. p. 32 and 33.

the outermost lamina, or whorl, causes the singular pulley-like appearance of the edge.

The abnormal construction of this operculum fully entitles the form to distinction on the same grounds as those on which the other genera of the *Cyclostomacea* rest. I do not hesitate, therefore, to separate it, under the designation some time since proposed in my correspondence with Dr. L. Pfeiffer, on a view of the species brought home by Lieut. W. Taylor, which subsequently appear to have passed into the hands of Mr. Cuming; carefully guarding it from the intrusion of other tubuliferous shells, belonging to *Alycæus* and *Pterocyclos*, which Albers has proposed to associate with it in a paper published in the 'Zeitschrift für Malakozoologie' for 1852. Dr. Pfeiffer opposed that view, and, while objecting to the separation of *O. Taylorianus* from *Cyclotus*, showed that Albers' scheme would unite shells belonging to several distinct types under the name which I had restricted to a portion. The peculiar structure of the operculum, to which those of *Aulopoma* and *Pomatias* only exhibit a faint resemblance in their hollow construction, has hitherto escaped observation.

Genus *Opisthoporus*, nobis.

Operculum calcareum, circulare, crassiusculum, multispiratum, duplex, utrinque concaviusculum; disco interno, epidermide cornea lubrica vestito, externo calcareo, scabro; duobus lamina spirali, erecta recurva interposita, junctis; anfractuum interstitiis interne vacuum præbentibus; margine circumdante concavo.

Testa depressa, orbicularis, late umbilicata, sutura pone aperturam tubulo exserto, pervio, munita. Peristoma duplex, externum expansum, superne antice subfornicato-alatum, internum superne interdum emarginatum breviterque incisum.

Sp. 1. *Opisthoporus biciliatus*, Mousson.

SYN. *Pterocyclos biciliatus*, Mouss. Java Moll. p. 49. tab. 20. f. 9 (1849).

*Cyclotus Taylorianus*, Pfr. 1851, Zeitschr. p. 7.

*Cyclostoma (Pterocyclos) Charbonnieri*, Recl. Journ. Conch. 1851, vol. ii. p. 214. t. 5. f. 12, 13.

Sp. 2. *Opisthoporus rostellatus*, Pfr.

SYN. *Cyclotus (Cyclostoma)*, Pfr. Zeitschr. 1851, p. 8, and Mon. p. 40.

Sp. 3. *Opisthoporus spiracellum*, Ad. and Reeve.

SYN. *Cyclostoma spiracellum*, ditto, Voy. Samarang, p. 56. t. 14. f. 1.

Sp. 4. *Opisthoporus tubuliferus*, Pfr.

SYN. *Cyclotus tubuliferus*, ditto, Mal. Blätt. vol. i. p. 31.

The circumstance of the tube in the suture of the last-quoted

species being directed forwards will not render any change necessary in the name, the tube being still posterior with reference to the aperture. The description of the mouth, tube, and operculum of *O. spiracellum*, brought by the Samarang from an island off the N.E. point of Borneo, permits no doubt of its place being in the proposed genus. Pfeiffer has placed it, with a mark of doubt, in *Pterocyclos*, while he surmises that it may be the same species as the Singapore *rostellatus*. The inflated back, and strangulation of the last whorl militate against this conclusion. The genus occupies a range from Singapore, through Borneo, towards the Manilla group.

The place which *Opisthoporus* holds will be found, as fixed for the type by Pfeiffer, between *Cyclotus*, to which it is linked by the abnormal species *C. variegatus*, Swainson, and *Pterocyclos*; the aberrant form, *Pt. hispidus*, Pearson, forming the passage to the typical species of the latter genus, and agreeing with *Opisthoporus* in the aperture and sutural tube; while it holds to *Pterocyclos* by the operculum. Not having *C. variegatus* at hand for comparison, I cannot say if the internal structure and edge of the thickened operculum resemble that of *Opisthoporus*, but, in the absence of the spiral elevated lamina at the edge of the turns, it decidedly gives warning of a departure from the received Cyclotoid type. If it should be found eventually to exhibit the structure of the operculum of *O. biciliatus*, inasmuch as the suture is destitute of a tube, the name which I have imposed will be held inapplicable to all the species, and, in that case, it may be desirable to use one of more general application, when the term *Cælopoma*\*, nobis, may be substituted.

It may here be remarked that, on the strength of the tectiform canaliculate wing, Pfeiffer has admitted *Cyclostoma breve*, Martyn, and *C. planorbulum*, Lamk. (genus *Myxostoma*, Trosch.) into *Pterocyclos*, from which the difference of substance and the plane laminar structure of the multispiral opercula appear wholly to exclude them. Now as *C. planorbulum* of the 'Encyclopédie Méthodique' was clearly the typical species of *Cyclotus*, Guilding, as made known by Swainson, it may be ultimately advisable to separate this shell from *Pterocyclos* under Guilding's name, and to restore Troschel's name *Aperostoma* to the shells bearing the form of operculum which Troschel had especially in view in proposing that division. After *C. planorbulum*, Swainson quoted *C. variegatum* as an additional species of the type; and it will depend upon the internal structure of its operculum, whether, as is most probable, it should be associated with *planor-*

\* *Cælopoma*—κοῖλος, cavus, and πῶμα, operculum.

*bulum* as a true *Cyclotus*, Guild., or with *Taylorianus*, &c. as an *Opisthoporus* or a *Cælopoma*.

In respect to *Pterocyclos* (*Lituus*) *brevis*, Martyn, I am disposed to associate it with *Cyclophorus* rather than with *Pterocyclos*. The wing is not truly Pterocycliform, and is rather an exaggerated representation of the angle and sulcus observed in *C. Nilagiricus* and other *Cyclophori*; while the thickened, horny, multispiral, and slightly concave operculum is closely related to the same form. The internal face of the operculum has not been yet described. It is smooth, the margin encircled with a thickened, slightly elevated band; and the centre is occupied by a broad convexity, with a more prominent central reddish translucent boss,—a feature observable in *C. Perdix* and its allies. The thimble-shaped operculum of *Pterocyclos*, horny or cartilaginous, with a calcareous skeleton or foundation, perforated in the centre when denuded of its outer coating, can scarcely be said to have any affinity with it.

Of another shell, *Pt. incomptus*, Sow., classed by Pfeiffer with *Pterocyclos*, I can say little. Its operculum is not known. The prediction may however be ventured, that, when examined, it will be found that the form will have no *locus standi* in *Pterocyclos*. The wing here indicates an analogy, not an affinity to the genus, and it may be expected that its operculum will be so constituted as to associate it with such species as *Cyclotus giganteus* and *Inca*.

As every notice regarding the unrecorded opercula of the *Cyclotomacea* tends to establish our knowledge of the family, the following descriptions, in addition to those given in a recent paper, will not be without their use.

*Cyclotus semistriatus*, Sow.

Operculo calcareo, arcte 6-spirato, nucleo planato; margine anfractuum 4-5 exteriorum acute elevato, subreflexo, interstitiis concavis profundis, scabre oblique plicatis.

From specimens taken alive at Kirkee in the Deccan.

*Cyclotus filocinctus*, Bens.

Operculo extus concavo; anfractibus paucis, margine scabre elevato.

*Cyclophorus cuspidatus*, Bens.

Operculo tenui concavo, corneo, arcissime spirato, margine anfractuum lineari.

*Cyclophorus Indicus*, Desh.

Operculo crassiusculo, obscure rubello-corneo, 6-spirato, extus scabro,

marginæ anfractuum elevatiusculo, lineari, intus lubrico, umbone centrali exiguo munito.

From specimens which reached London alive, from the Concan, near Bombay.

*Cyclostoma marginatum*, Chemn.

Under this name Pfeiffer cites *Turbo marginatus*, Ch., from Coromandel, in his list of doubtful species. Mon. p. 313, with the observation that it may rather be a *Bithinia*. The latter supposition is correct. I have this shell, clearly indicated by Chemnitz, sent by Dr. Jerdon from the Carnatic, and by Mr. Edgar Layard from Jaffna in Northern Ceylon. It is the shell which Souleyet (Voy. de la Bonite, vol. ii. p. 547. t. 31. f. 19-21) has described and figured as *Valvata sulcata*, from a pond near Pondichery, although he has omitted to describe the delicate striæ by which the spiral ridges are decussated. Souleyet has erred in ascribing the shell to *Valvata*. The testaceous operculum confirms its place in *Bithinia*. Souleyet says it is "vix spiraliter striatum;" his engraver exhibits an operculum with concentric striæ. The truth evidently lies between, and, as in other *Bithiniæ*, there must be a central spiral nucleus, followed by concentric laminæ. Unfortunately my specimens are destitute of opercula. The shell will henceforth stand as *Bithinia* (*Turbo*) *marginata*, Ch.

Spa, 24th November 1854.

IV.—*On Artificial Sea Water.* By PHILIP H. GOSSE, A.L.S.

*To the Editors of the Annals of Natural History.*

GENTLEMEN,

IF Mr. Warington supposes that I obtained from him one atom of information previously unknown to me, on the subject of making sea-water from its constituent salts, he is most thoroughly mistaken. He is no less wrong in saying that I "consulted" him; since I merely mentioned what was on my mind in familiar conversation.

With this, however, the public are of course not concerned, and I shall say no more on that head.

Such of your readers as have felt interested in the matter may be assured that I have not deceived them, in the statement that the simple formula given in the 'Annals' for July 1854 will make sea-water, in every respect fit for an aquarium, and capable of supporting animal and vegetable life.

*Ann. & Mag. N. Hist.* Ser. 2. Vol. xv.